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Polychaete Larvae of the Hawaiian Coastal Waters

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ABSTRACT

Polychaete larvae of fifteen species, representing nine families are described from Hawaiian waters. The literature on twenty-two families is also presented. The larvae were collected from Kaneohe Bay, Ala Wai Canal, and Hawaii Kai by plankton tow. The larvae were raised in petri dishes, observed daily, drawings and photomicrographs were made to record the stages of development. Larvae of the families POLYNOIDAE, PHYLLODOCIDAE, SYLLIDAE, NEREIDAE, SPIONIDAE, CHAETOPTERIDAE, OPHELIIDAE CAPITELLIDAE, and SERPULIDAE were studied.

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INTRODUCTION

The polychaetes are a very important part of the marine ecosystem. Kohn and Lloyd (1973) found 49,000 polychaetes/M^2 in the shallow reefs of the Indian Ocean. The adults are utilized by numerous fish for food both in the Pacific (Hiatt and Strasburg, 1960) and the Caribbean where Randall (1967) found the remains of polychaetes in the stomachs of 62 species of fish representing 24 families. For seven of these fish species the polychaetes were the largest group of food organisms. Polychaetes are also fed upon by invertebrates, including the mollusc *Conus* spp.. Kohn (1968) found that in the 13 most abundant species of *Conus* inhabiting the atoll reefs of the Maldive and Chagos Islands, 96% of their food is composed of polychaetes. They are also of ecological significance because they eat encrusting organisms such as bryozoans and sponges. The polychaetes are themselves fouling organisms which plague boaters, aquaculturists and others (Straughan, 1968 and 1972). Some are able to bore into calcium carbonate and affect the structural stability of coral reefs (Marsden, 1962; Blake, 1969a; Scoffin, 1972).

Considering how important polychaetes are, little work has been done on larval development and life cycles. D.P. Wilson (see bibliography) and G. Thorson (1946) have probably contributed the most to our knowledge of polychaete larvae, including a number of extremely useful papers; this is still a superficial job when one considers the number of species that are left to be studied.

Very few of the families have been observed to date and those that have were chosen for economic reasons. Many of their members are foulers affecting shipping and harbor management as well as aquaculture of oysters and other commercially valuable animals. There is only one taxonomic key to all of the families of polychaete larvae (Bhaud, 1967), it does not go beyond the family level. There have been a number of keys to the SPIONIDAE (Hannerz, 1956, 1961) and the genus Polydora (Blake, 1969) but none to my knowledge for any of the other families. The taxonomic keys available for the adults cannot be used for the larvae because of morphological differences which can be great. The larvae might have an extra pair of eyes, only a few of their tentacular cirri, or the setae may be quite different from those it will have as an adult. Marsden (1960) did some work on reef dwelling Caribbean polychaetes and included information on the larval forms of 8 species, but to date there have been no studies on the Hawaiian polychaetes. The majority of the larval studies have been carried out using North Atlantic species.

There are two basic approaches to studying polychaete larvae-

1.) Plankton studies-collect plankton samples, sort out the polychaete larvae and raise them in the laboratory.

2.) Embryological studies-In the laboratory, mix together viable sperm and eggs and raise the embryos.

The second approach is more reliable because you know which genera and species you are working with and it is possible, at least in some cases, to raise the larvae from the egg up to the adult (Wilson, see bibliography). This eliminates the problem of trying to collect larvae that are brooded by the parent and so never become a part of the plankton.

The main problem with the first approach is that you get only part of the life cycle, for example, if you collect a 10-setiger stage worm you do not know what the previous stages looked like. Then if the larva dies at the 15-setiger stage you are left with gaps in the life cycle and chances are you were never able to positively identify it. However, if you raise a larva from the embryo to the 15-setiger stage and it dies, you have a complete picture from egg to 15-setiger larva. You already know which species you are working with, so the life cycle information is more complete and thus more useful.

Thorson (1946) used the first approach and often had difficulty making positive identifications of the larvae he found, for example, Polynoid "A", "B", etc.. His paper is still very useful because of his numerous, detailed and accurate illustrations, the descriptions of the larvae and his excellent review of the current literature. D.P. Wilson (see bibliography) on the other hand, used the second approach and his results are extremely useful for getting a picture of a worm's complete life cycle. He succeeded in raising a number of species from the egg up to metamorphosis and through to adulthood. Wilson's papers are helpful because of his sequential illustrations and detailed descriptions. Other researchers have successfully used the second approach of larval rearing (Hopkins, 1958; Dean and Hatfield, 1963; in the United States; Guérin, 1970, '71, '72a and 1973b; Cazaux, 1964, '69, '72, in France, to name a few).

I have identified 15 species from 9 families based on my preliminary work (July-Aug. 1975) on the Hawaiian polychaetes. The larvae were collected by plankton tow, except for Spirobranchus giganteus which was totally laboratory reared. The families represented are:POLYNOIDAE, PHYLLODOCIDAE, SYLLIDAE, NEREIDAE, SPIONIDAE, CHAETOPTERIDAE, OPHELIIDAE, CAPITELLIDAE and SERPULIDAE. The three most commonly encountered species were Polydora antennata Claparède, Polydora websteri Hartman and Capitella capitata(Fabricius). Capitella is a genus that has not previously been reported from Hawaii but it has a cosmopolitan distribution. As soon as enough specimens have been collected and permanent mounts made of them they will be forwarded to Dr. D. Reish at Calif. State Univ., Long Beach and Dr, Bernard Thomassin, Marsielle, France, for positive identification. It is an indicator of polluted conditions and disturbed environments. Another possible new record, which was found in the spring and summer of 1975, is Ophelia bicornis Savigny, which has been reported from other areas of the Pacific (Gibbs, 1971) but not from Hawaii. Both of these species have benthic adults and it is because of their pelagic larvae that they were found. There has been some research on the deep-sea polychaetes from Hawaii (Hartman, 1966; Bailey-Brock, 1972) as well as some work on the benthic polychaetes from the Hawaiian islands (Bailey-Brock, in press) but the species composition and ecology of polychaetes in Hawaii is still incomplete.

There is still a great deal of work to be done on the polychaete larvae. One of the problems that still needs to be studied is larval settlement; how are they affected by light, temperature, salinity changes, substrate types, etc. and what affects their metamorphosis? Information on what the larvae eat, if they do eat, is lacking. Studies on larval behavior as well as their life cycles will have to be continued in order to get a complete developmental pattern for larval polychaetes.

Despite all the work that has been done approximately two thirds of the families and numerous genera and species are left to be investigated. Much more research is needed on the pacific polychaetes, including those of the Hawaiian Islands.

METHODS AND MATERIALS

Polychaete larvae were collected approximately once a week from July 1, 1975 to Aug. 30, 1975, from three Oahu locations: Hawaii Kai, Maunalua Beach Park Bridge, Ala Wai canal and Kaneohe Bay, near Coconut Island. Plankton tows were taken from piers or bridges at all three locations and at various tidal periods. At Kaneohe Bay tows were also made using a Boston Whaler.

The larvae were raised in petri dishes containing water from Kaneohe Bay. They were not fed as this seemed to encourage the growth of bacteria and ciliated protozoans which resulted in the death of the polychaete larvae. The water was changed whenever an increase of bacteria or protozoans became evident, and to compensate for increased salinity, a result of evaporation.

The larvae were observed daily and notes taken on their progress. Drawings were made of the live larvae when they were first collected and photomicrographs were taken at intervals. using a 35mm. Pentax camera and a Ricoh brand microscope adaptor.

During the project any adult polychaetes that were found were studied in order to become more familiar with their morphology and the use of taxonomic keys.

KEY

Key to the families of Hawaiian polychaete larvae taken from the plankton during the spring 1975 and from July 1, to Aug. 31, 1975.

1. Larvae are long (2 or more segments) and vermiform 2

1. Larvae are top-shaped, composed of 2 hemispheres 9

2. Dorsum bears elytra (overlapping scales), (fig. 1)..POLYNOIDAE

2. Dorsum without elytra 3

3. Parapodia with paddle-shaped dorsal cirri, (fig. 4).PHYLLODOCIDAE

3. Dorsal cirri absent or otherwise 4

4. Later stage larvae (14-17 setigers) with a pair of long anterior dorsal palps (fig. 15); or earlier stage (7-10 setigers) without the long palps, but with very long capillary setae (fig. 9) ....SPIONIDAE

4. Setae and head structures otherwise 5

5. Prostomium bears 2 pairs of red eyes 6

5. Prostomium with eyes otherwise 7

6. 3-setiger stage has compound setae with short blades (fig. 6) ....SYLLIDAE.

6. 3-setiger stage has compound setae with long blades (fig. 7), older forms have biarticulate palps ...... NEREIDAE

7. 3 black eyes; prostomium and peristomium without appendages, parapodia with long capillary setae (fig. 29) .... OPHELIIDAE

7. Prostomium with 3 pairs of red eyes and a pygidium bearing an anal projection (palp) (fig. 24) .......................CHAETOPTERIDAE

7. Prostomium with 1 pair of red eyes 8

8. Larvae with capillary setae anteriorly and hooked setae posteriorly (fig. 29) ............CAPITELLIDAE

8. Larvae with compound setae only .... SERPULIDAE

9. Green trochophore with an elongated post-trochal region (fig. 2) .........................PHYLLODOCIDAE

9. Transparent, both hemispheres are even in size ... SERPULIDAE (fig. 33)

Family-POLYNOIDAE

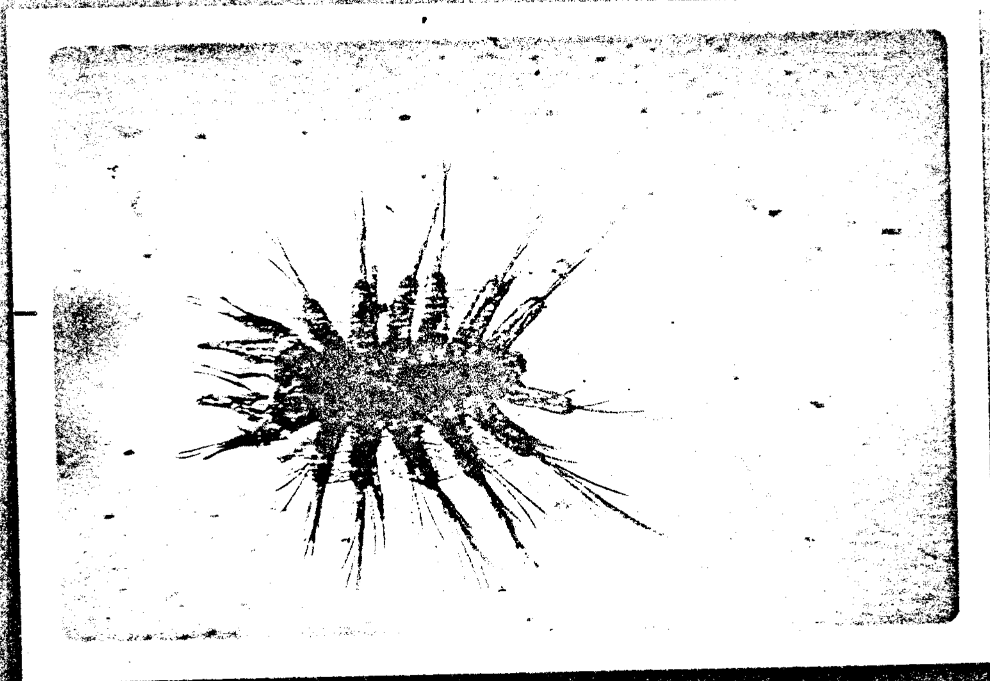
Genera found in Hawaii-Hololepiedella, Iphione, Lepidasthenia, Lepidonotus, Thormora

Literature:

Adult scale worms are benthic, detrital feeders which live on muddy surfaces (Day, 1967). Of the 5 genera found in Hawaii only the larva of Lepidonotus has been described (Thorson, 1946). According to Thorson the larvae have a kidney shaped prostomium whose ends are converging or parallel; the cirrophores of the lateral tentacles arise from the terminal part of the prostomium. The females of the POLYNOIDAE keep the embryos under the elytra(scales) until they hatch as trochophores. The larvae are planktotrophic and they metamorphose at about the 8-setiger stage (Thorson, 1946).

Own Remarks:

A single specimen, believed to be a Lepidonotus larva was found in plankton from Kaneohe Bay, Oahu, (fig. 1). It was 6-setigerous segments long with three pairs of claer, round elytra. The setae were long, toothed, capillaries; the notosetae were longer than the neurosetae. The larva had two pairs of black eyes, the anterior pair being more lateral than the poaterior pair. There was one pair of peristomial cirri (tentacles) and one medial cirrus as well as one pair of peristomial cirri. There was also one pair of pygidial cirri, ventral cirri on each segment and dorsal cirri on the segments without elytra. The polynoid larvae are difficult to maintain in the laboratory.



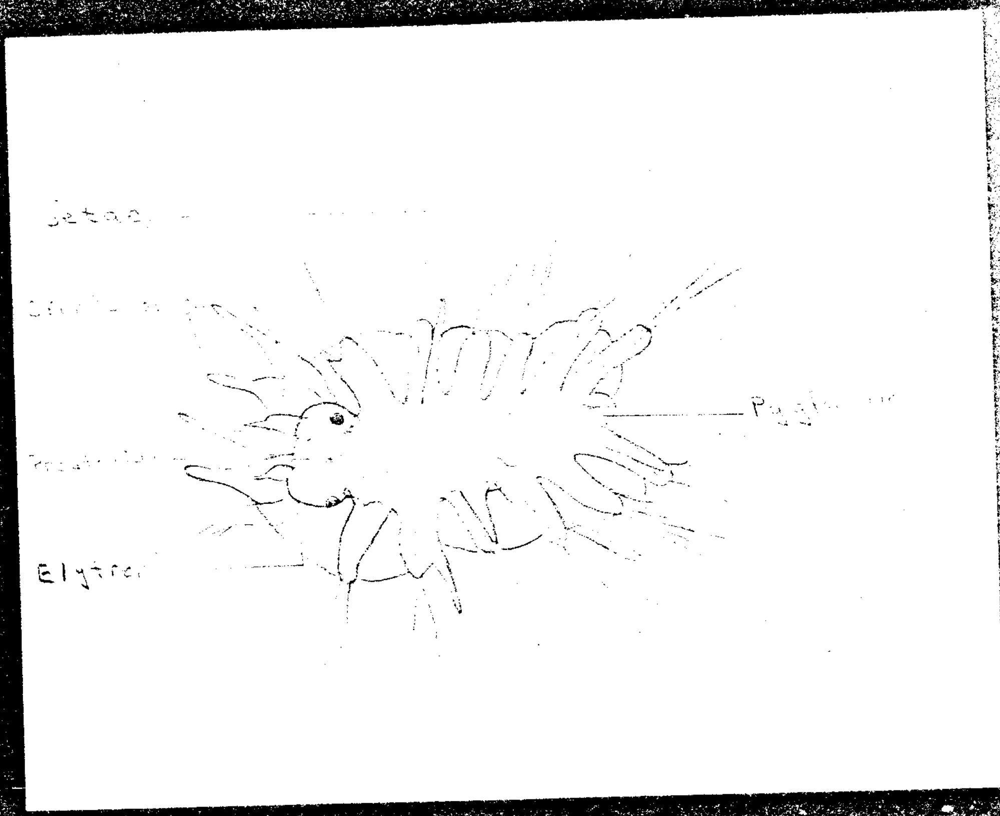


Figure 1. 6-setiger POLYNOIDAE; 100x.

Family-AMPHINOMIDAE

Genera found in Hawaii-*Chloeia*, *Eurythoe*, *Hipponoe*, *Notopygos*, *Pareurythoe*, *Pherecardia*.

Literature:

Adults are usually sluggish carnivores feeding on soft-skinned attached animals such as sponges, hydroids and ascidians, *Pherecardia* is an active predator. Most species occur in warm or tropical seas on rocks, coral or other hard substrate covered with attached organisms (Day, 1967).

Marsden (1960) raised the larvae of *Eurythoe complanata* for 16 days. They had an umbrella-shaped trochophore with an elongate posttrochal region, ; at 14 days they reduced the size of the pretrochal hemisphere and then sunk to the bottom of the dish and began to crawl about. The larvae did not survive to metamorphosis.

Own Remarks:

None have been found.

Family-PHYLLODOCIDAE

Genera found in Hawaii-Eulalia, Eumida, Phyllodoce, Prophyllodoce

Literature:

The adults are known to occupy many types of habitats. Benthic forms are long and slender and are found in cracks and crevices while the planktonic forms are short and fat (Day, 1967). It has not been determined what the adults eat but food has been found in their guts.

The fertilized eggs are laid in a gelatinous mass and are then either carried by the female, or are attached to the substratum or to fronds of algae (Thorson, 1946). Thorson also found that the length of the pelagic life of the larvae of this family is related to larval size; for example, adults of the genus Phyllodoce have four pairs of tentacular cirri, they have a large metatrochophore and nectochaete larva (10-30 setigerous segments), with a well developed pelagic phase. On the other hand adults of the genus Eteone, have two pairs of tentacular cirri, and are smaller than adults of Phyllodoce. The metatrochophore and nectochaete larvae of Eteone are small (5 setigerous segments), with a short, lecithotrophic, pelagic phase, these larvae have a benthic phase crawling on the substrate with the aid of cilia.

Own Results:

Collections last spring produced a green egg mass on a piece of the chlorophyte Ulva sp. near a worm tube composed of mud. The trochophores were moving within the mass.

One day later the trochophores had hatched out of the egg mass and were slowly swimming around on the piece of Ulva. The posttrochal region had become extended and prostomial cirri buds were visible on some of the trochophores (fig. 2). On the second day each larva had developed a pair of red eye spots, was four segments long and they all now had buds for the prostomial and anal cirri as well as parapodia (fig. 3). By the fourth day setae were visible and pygidium were pronounced. The larvae continued to develop until they reached the 5-setiger stage (fig. 4), they remained at this stage until their death about two weeks later. This is possibly the time when metamorphosis should have occured; but conditions were not suitable for the completion of metamorphosis and settlement. The one very distinctive characteristic of these larvae were their light green color which they had from the trochophore till the 4-setiger stage.

During July an 8-setiger larva was collected from Kaneohe Bay, it had a heart-shaped prostomium, four pairs of tentacular cirri, one pair of anal cirri, paddle-shaped dorsal cirri, compound setae and one pair of red eyes (fig. 5).

Thorson (1946) says that the number of tentacular cirri can be used for identifying the larval PHYLLODOCIDAE. I feel that this needs to be looked into further, larvae found with only two pairs of tentacular cirri could just be a young form of a worm with four pairs of tentacular cirri. It would be advantageous to rear larvae of this family in the laboratory to find out which is the case.

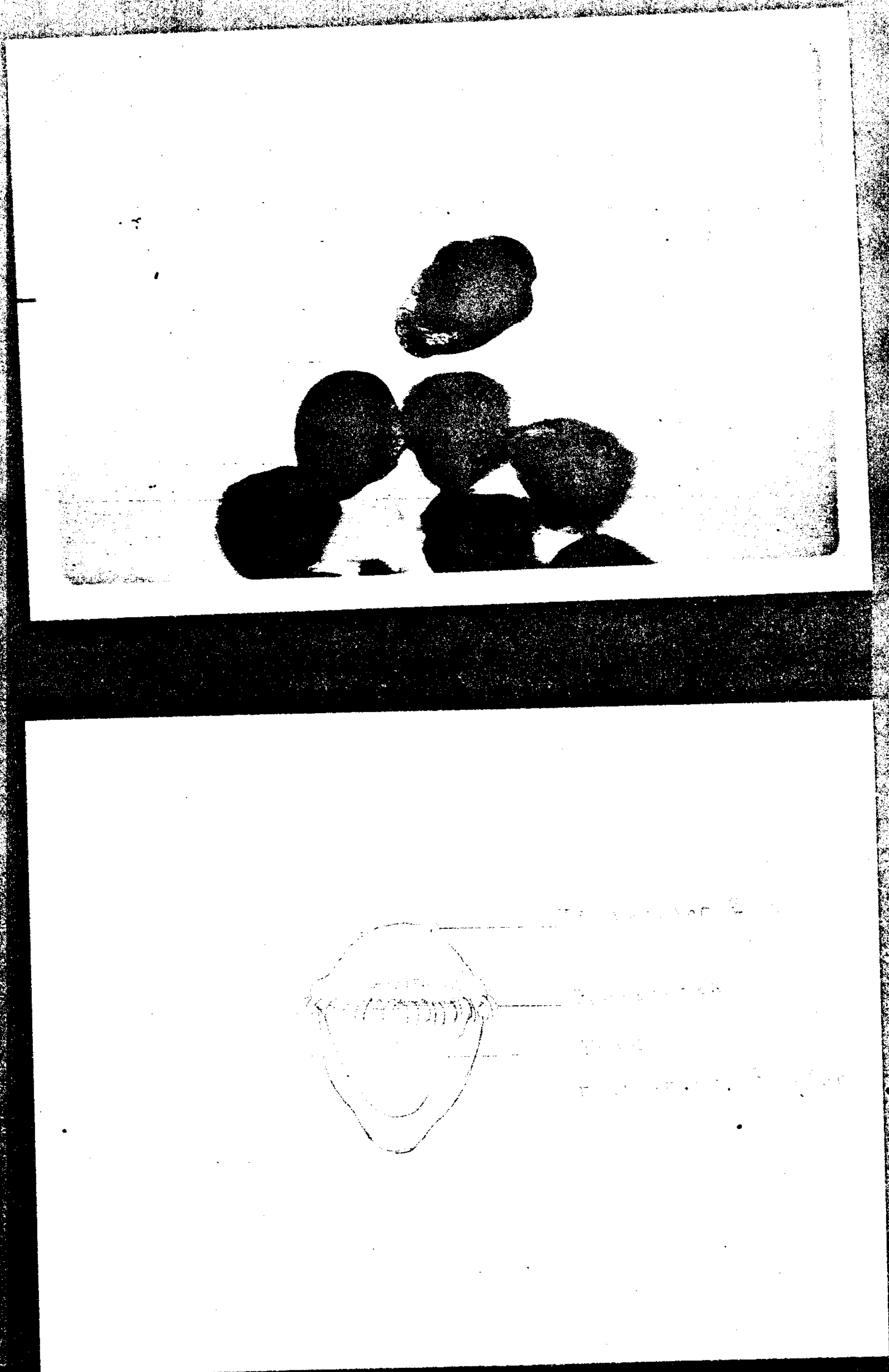


Figure 2. Trochophore, PHYLLODOCIDAE; 100x.

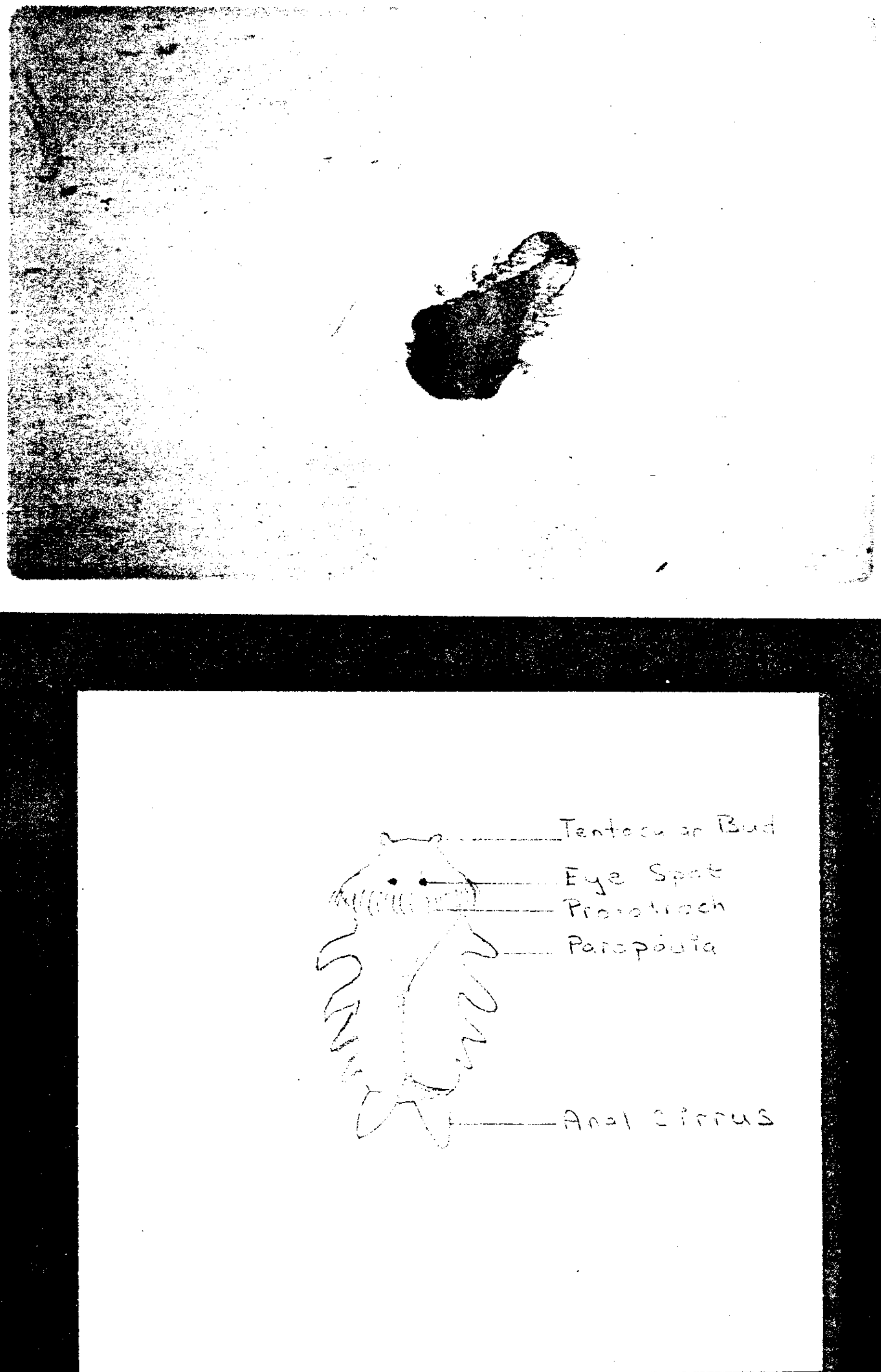
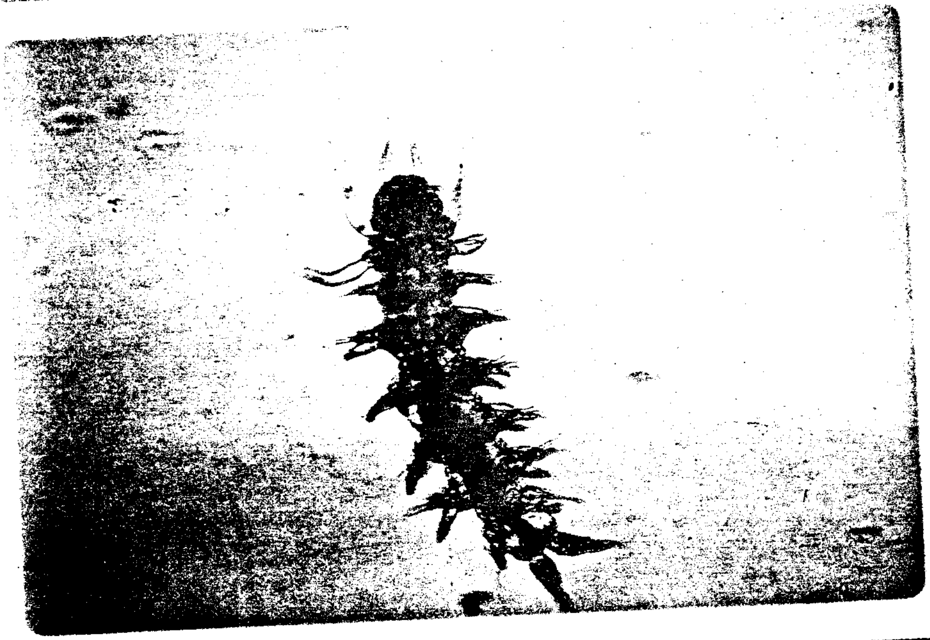


Figure 3. 4-segmented PHYLLODOCIDAE; 100x.



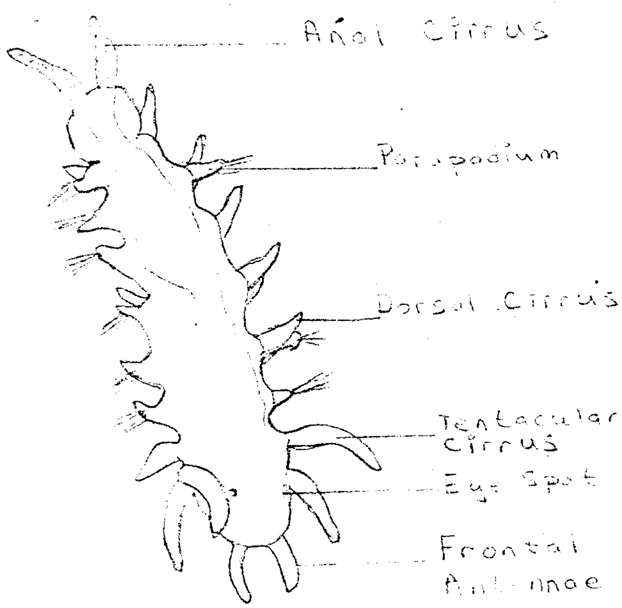
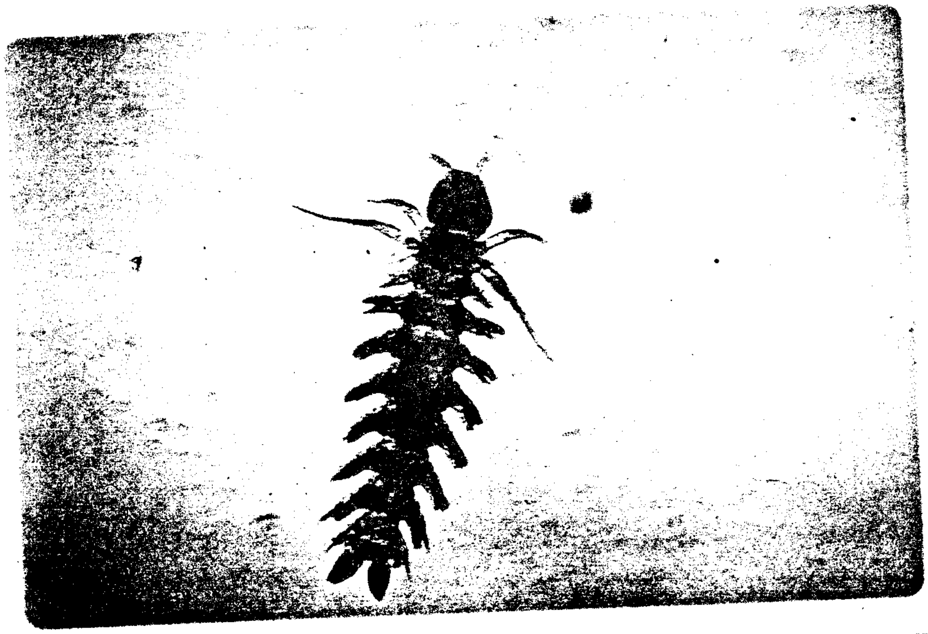


Figure 4. 5-setiger PHYLLODOCIDAE; 100x.



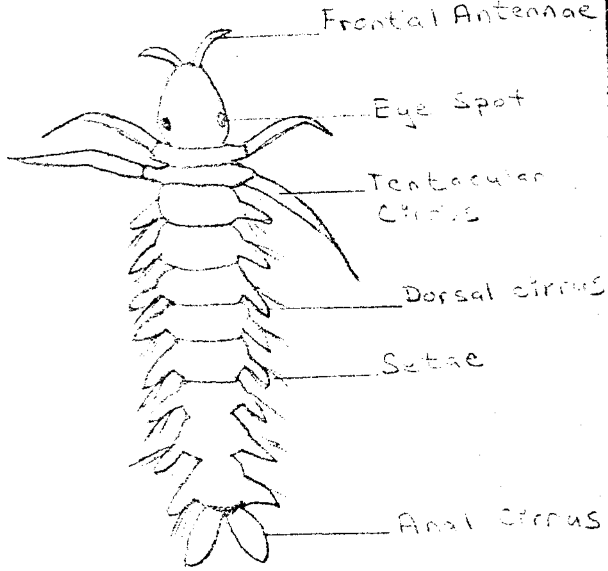


Figure 5. 8-setiger PHYLLODOCIDAE; 100x.

Family-ALCIOPIDAE

Genera found in Hawaii-<u>Alciopa</u>, <u>Naiades</u>, <u>Vanadis</u>.

Literature:

The adult Alciopidae are known for their large eyes which have spherical lenses, cup-shaped retinas and special optical lobes to the brain. They are planktonic, rapid swimmers and have an eversible, muscular proboscis sometimes provided with a pair of lateral projections for grasping prey. The type of prey is unknown.

There is no information available on their larval development.

Own Remarks:

None have been found to date.

Family-TOMOPTERIDAE

Genus found in Hawaii-Tomopterus

Literature:

The adults are pelagic, there is little known about their biology.

Thorson(1946) found that the larvae of the tompterids are planktonic and even the youngest stages found, (380μ long) had a prototroch, one pair of budding tentacles and three pairs of distinct parapodia without setae. The young larva resembles the adult and the older ones are nearly as easily recognizable as the adults.

Own Remarks:

None have been found.

Family-HESIONIDAE

Genera found in Hawaii-*Hesione*, *Leocrates*, *Podarke*,

Literature:

The adults are active polychaetes and in some cases carnivorous. *Hesione* and *Leocrates* are large worms with irridescent colors, they can be found under stones and dead coral heads (Day, 1967).

There is no information available on the larval forms of any members of this family.

Own Remarks:

None have been found to date.

Family-SYLLIDAE

Genera found in Hawaii-Branchiosyllis, Exogone, Myrianida, Opisthosyllis, Parasphaerosyllis, Sphaerosyllis, Syllis, Trypanosyllis and Typosyllis.

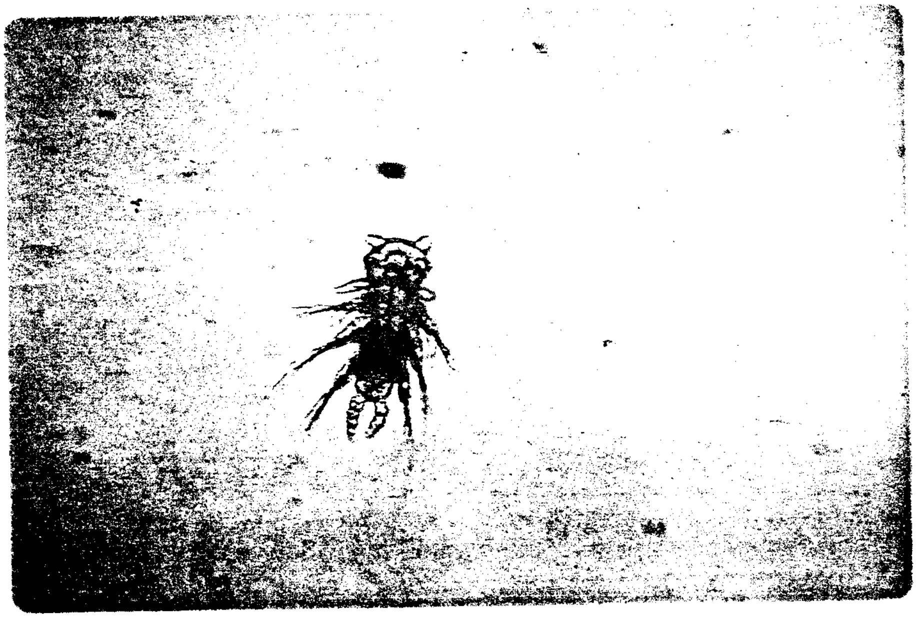
Literature:

The adults are benthic and can be found crawling over sponges, hydroids, coralline algae and other encrusting organisms.(Day, 1967). Some burrow into coral rubble. Kohn& Lloyd (1973) found densities of 11,700-63,600 syllids/M^2 of coral rubble. Syllids comprised 43-71% of the total polychaete community in the intertidal region of the Indian Ocean. The syllids [illegible] eat encrusting organisms and detritus which makes them an important aid in controlling foulers.

The Exogeninae carry their developing eggs on their back (Thorson, 1946). The eggs are rich in yolk, the larvae are benthic.

Own Remarks:

A number of larvae were collected from Kaneohe Bay in July. One specimen probably of the subfamily Syllinae, had five setigerous segments, it was uniramous with very long compound setae. It had one pair of red eyes, its jaw was already visible as was the gut which had yolky material in it. The palps were not fused. It had two pairs of prostomial cirri and a medial oneas well as three pairs of peristomial cirri. There were long smooth dorsal cirri and shorter ventral ones on each segment. There was also one pair of pygidial cirri. No pigmentation was present. A second specimen was only three setigerous segments long, it had one pair of red eyes. The jaw buds and of the prostomial, peristomial and pygidial cirri were present. The parapodia had long, compound setae, (fig. 6).



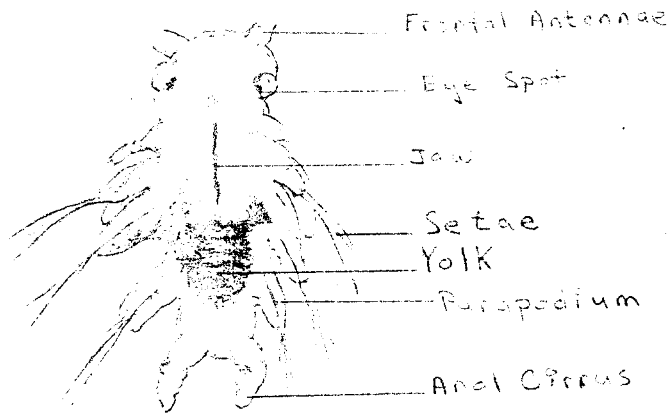


Figure 6. 3-setiger SYLLIDAE; 100x.

Family-NEREIDAE

Genera found in Hawaii-*Ceratonereis*, *Namalycastis*, *Nereis*, *Perinereis*, *Platynereis*, *Pseudonereis*

Literature:

The adults are benthic omnivores, some of which are mud burrowers (Day, 1967).

Life history studies on the NEREIDAE from temperate waters reveal that the adults swarm, eggs and sperm are extruded into the water where external fertilization takes place. The eggs remain in the plankton where they develop into trochophores, except *Nereis vexillosa* which Johnson (1943) found to be the only nereid which lays its eggs in an egg mass where they develop. The early larvae have buds which are the future tentacles, tentacular and anal cirri. In nature they do not seem to have a pelagic phase, other than the trochophore. Wilson (1932) raised *Nereis diversicolor* in the laboratory and got a pelagic phase of 14 days. This demonstrates the differences between field data and laboratory results. Dales (1950) also investigated *Nereis diversicolor* and found that the metatrochophores were benthic and weak swimmers. They were not very active until the 10-setiger stage.

Own Remarks:

A number of specimens were collected from Kaneohe Bay in August. One was 3-setigerous segments long, had two pairs of red eyes. The setae were compounds with very long blades. One pair of prostomial tentacular buds was present and there was a jaw rudiment (fig. 7). The second specimen was the same

as the first except that it was further along in its development. There was one pair of peristomial and pygidial cirri. The jaw was more developed and the yolk-filled gut was visible.
Ventral cirri were present on the first setigerous segment, (fig8). By this stage (5-setigerous segments) the palps had become biarticulate.

The distinguishing difference between the young nereids and syllids is the extremely long compound setae of the nereids.

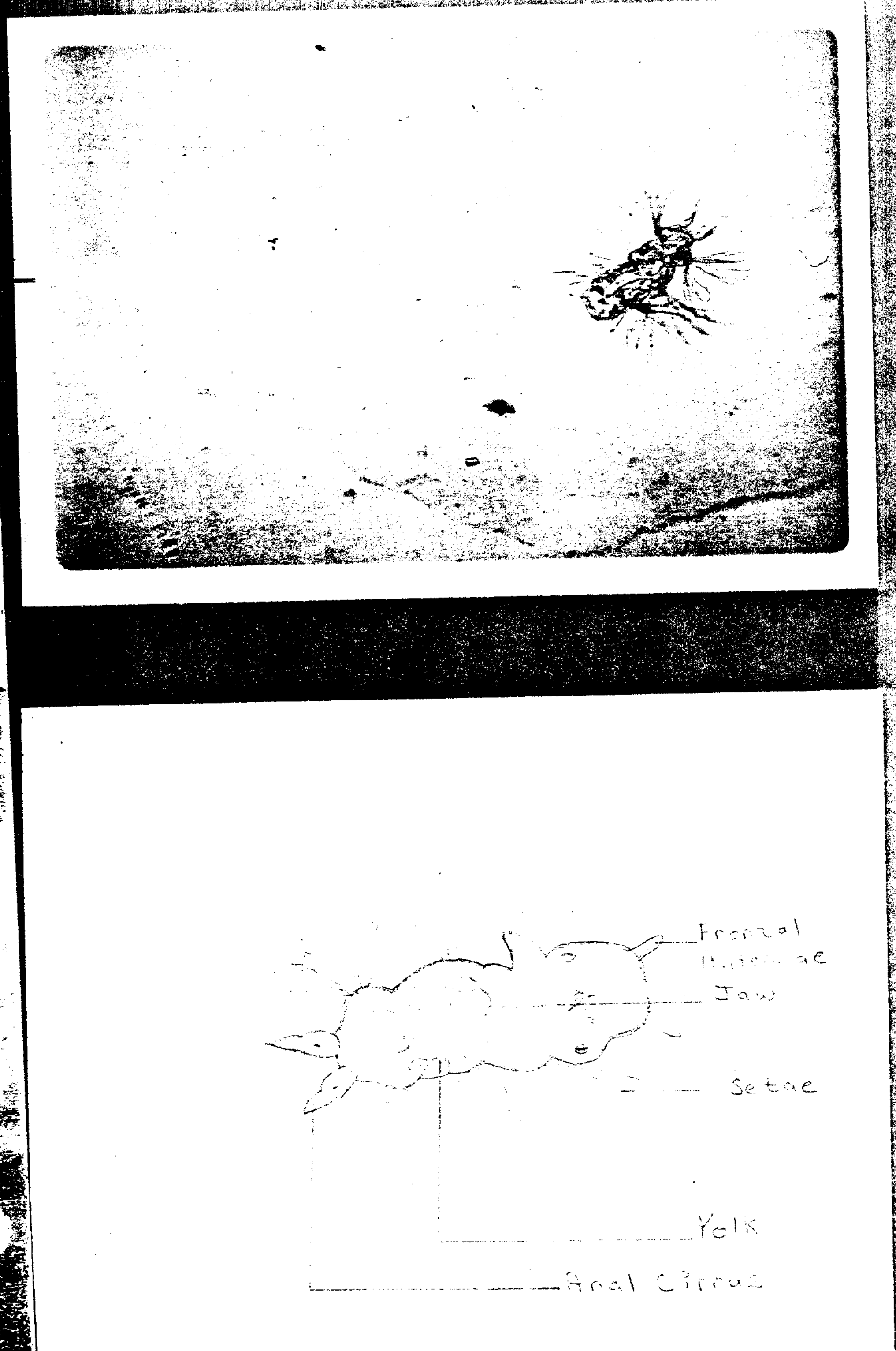
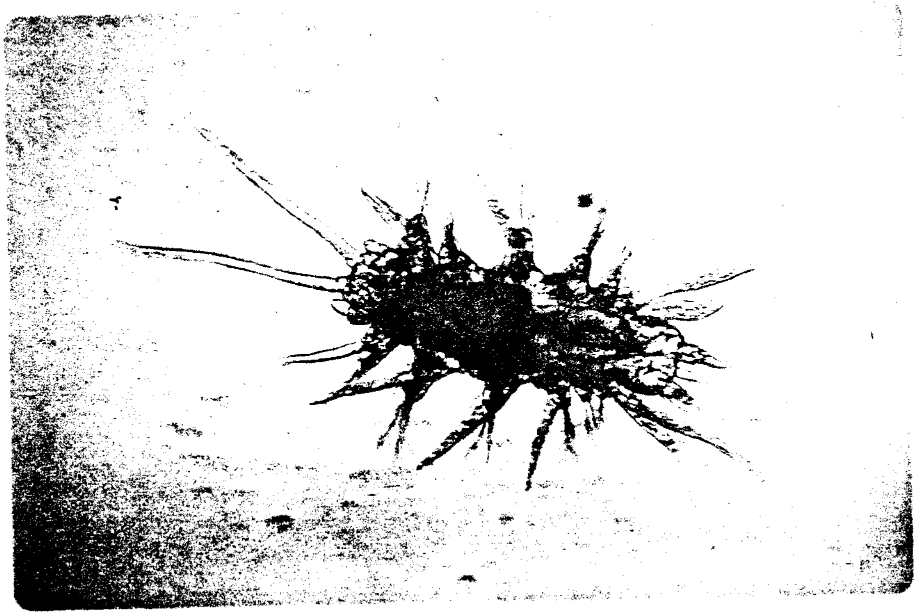


Figure 7. 3-setiger NEREIDAE; 100x.



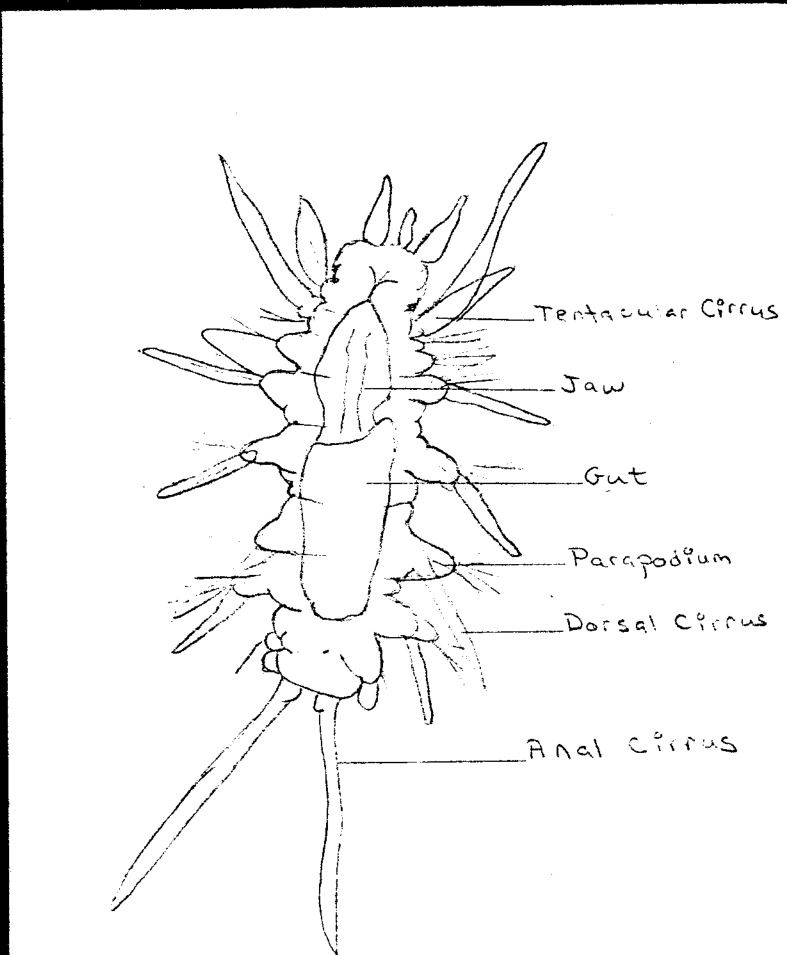


Figure 8. 5-setiger NEREIDAE; 100x.

Family-GLYCERIDAE

Genus found in Hawaii-Glycera

Literature:

The adults are active burrowers, found in sandy substrates. They burrow by means of an eversible proboscis. Most species are thought to be predators or at least carnivores (Day, 1967).

Thorson (1946) found the larvae of the Glyceridae at the eight to nine setiger stage to be easily identified because of their cone-shaped prostomia, each with four tentacles.

Own Remarks:

None have been found to date.

Family-EUNICIDAE

Genera found in Hawaii-Eunice, Lysidice, Marphysa, Nematonereis, Palola.

Literature:

Some adults are benthic creepers, others are burrowers, they are omnivorous, feeding mostly on detritus, (Day, 1967).

The genus Palola has been studied because of its spawing habits. The gamete bearing segments of this species are considered to be a delicacy by some cultures, i.e. the Samoans. The gametes of the Palola worm are shed freely into the water during mass swarming at the surface. The larva of the genus Eunice has a short pelagic phase, they are lecithotrophic, feeding on stored yolk, (Thorson, 1946). The early formation of the jaw apparatus appears to be characteristic of the eunicids.

Own Remarks:

None have been found to date,, this could be because of a short pelagic phase.

Family-ORBINIIDAE

Genus found in Hawaii-Naianeris

Literature:

The adults burrow in sandy mud but do not make permanent tubes. They ingest particulate organic matter. Naineris sp. can be found on rocky shores among holdfasts of algae (Day, 1967).

According to Okuda(1946) in Vannucci (1959) the larvae of Naianeris laevigata leave the egg-mass after the trochophore stage. The prototroch is a complete ring and there are no branchiae at the end of metamorphosis.

Own Remarks:

None have been found.

Family-SPIONIDAE

Genera found in Hawaii-Polydora, Spio, Prionospio, Aonides, Spionphanes.

Literature:

As adults they are deposit feeders which gather their food with extensible palps. They live in mucus-lined burrows or tubes in sandy areas, cracks and crevices. Polydora forms "mud blisters" on oysters and other molluscs of commercial value.

The paper by Hannerz (1956) is the most complete work to date on the family SPIONIDAE and their larval development. This paper has good illustrations and descriptions as well as a key to the genera.

Casanova (1952) worked on larvae of Polydora antennata (Claparède) taken from plankton samples. The youngest stage that he found was a 4-setiger stage, the larva remained pelagic until the 20-22 setiger stage whereupon it settled and made a tube.

Wilson (1928 b) found that the larva of Polydora ciliata Johnston remained in an egg sac until after the appearance of palps.

Woodwick (1960) investigated Polydora nuchalis Woodwick, and found that it also remains in the egg sac until a late stage, in this case the 12-setiger stage, but it will sometimes leave at the 9-setiger stage.

Polydora commensalis Andrews has a planktotrophic, pelagic larva which is liberated from the egg case at the 5-setiger stage and has a larval life of about one to one and a half months (Hatfield, 1965).

Hopkins (1958) says that the larvae of Polydora develop in chains of egg cases within the parent's tube and emerge at the 3-setigerous stage. He also says that it appears that there are larvae developing all year and that they emerge whenever the water temperature approaches 25°C. The largest planktonic larvae that he found had 17 segments and the smallest that were found on oysters also had 17 segments, which indicates that settlement takes place at this size. The larvae will settle on oysters all year but particularly under warm weather conditions.

The following are descriptions of some larvae from a number of SPIONIDAE genera from Hannerz (1961):

Polydora Bosc.

The body shape varies, there are three pairs of black eyes, the lateral ones are double. The palps become well developed, the pygidium is rounded and lacks appendages. Nototrochs are found, as are gastrotrochs which are not found in all segments, the telotroch is well formed. The nuchal organs appear as longitudinal ciliated grooves. The pigmentation is vivid and melanophores occur, pigmentation tends to be lacking in advanced stages. There are long, serrated larval setae in the younger stages but these disappear later and are replaced by shorter setae, with the setae in the fifth segment becoming specialized. There are no branchiae.

Prionospio Malmgren

This genus has an entirely pelagic development and plankotrophy predominates.

The body is long and slender with a rounded prostomium on which there are two pairs of eyes which are red except in

Prionospio malmgreni Claparède which has black eyes. The prototroch is well developed and there is a broad nuchal crest. Parapodia are differentiated at a relatively late date, setae are thin and lustreless. The pygidium develops up to three pairs of cirri, there is a ciliated pit in segments one to three, gastrotrochs occur in all the following segments and nototrochs develop in the anterior segments of older larvae. Pigmentation is slight. Branchiae are located on segments one to four or one to five, in later stages.

Spio Fabricius

The eggs are contained within jelly-like masses or egg-capsules in the female's tube. The developing larvae feed on nurse cells and they leave the protective covering at various stages.

The prostomium is stumpy and somewhat notched at the tip, there are three pairs of black eyes, the two lateral ones are double. The nuchal organs are longitudinal grooves located in segment two. Nototrochs occur from segment two onwards, gastrotrochs are found in alternate segments from segment three onwards. Parapodia are differentiated to a relatively high degree. The larval setae are thin. Branchiae are found in older stages starting from segment one or two. They have palps which do not reach more than half way down the body.

Spiophanes Grube

The head region bears two pairs of red eyes. One pairs of palps remain short and are attached far out on the lateral parts of the prostomium. The prototroch is well developed, nototrochs are present, and the telotroch is discontinous dorsally. Branchiae are lacking in all pelagic stages. The pygidium is rounded and is equipped with numerous cirri in older larvae. The larval setae are thin and lustreless. In older larvae the curved bristles typical of the genus are found in segment one. The "ciliated pit" is located on segment two and gastrotrochs occur in all segments posterior of segment two.

Aonides Claparede

The pelagic larva is in all stages characterised by the abundant yolk which gives it a yellowish, opaque appearance. Two pairs of red eyes are present. Pigmentation is lacking on the body. The larval setae are long and straight, gastrotrochs are found on all segments except the first.

Own Results:

In the spring of 1975 numerous larvae of Polydora antennata Claparede were found in plankton samples from Kewalo Basin and the Ala Wai canal. Most of the larvae found were of the 7-10 setiger stage (fig. 9). In these younger stages there can be only one large black eye spot or the three pairs as found in later stages. They already have the characteristic two rows of contracted dorsal melanophores. The larvae are short and fat, greyish in color, they have long, serrated setae. A prototroch and telotroch are present as well as a neurotroch. In the older larvae palps have formed (fig. 10 and 11).

During July and August Polydora antennata and P. websteri were two of the most frequently encountered larvae.

The larvae of <u>Polydora websteri</u> Hartman have short palps, a blunt prostomium with three pairs of black eye spots. They have long larval setae in the first segment. The melanophores are very distinctive, they are band-shaped ones in segments three to seven and contracted blobs in the remaining segments. Pigmentation is lost as they become older, this is in contrast to <u>Polydora antennata</u> which retains the pigmentation. Branchiae can be found in later larvae about segment seven, they do not continue all the way to the pygidium. The larvae tend to be more transparent and thinner than <u>P. antennata</u> (figs. 12-19).

The best method for distinguishing the two species is their body size, color and pigmentation; <u>P. antennata</u> is darker and fatter than <u>P. websteri</u> and it has contracted melanophores down the entire dorsum while <u>P. websteri</u> has contracted melanophores only posterior to segment seven. <u>P. antennata</u> is shorter and fatter than <u>P. websteri</u>.

During the spring and again during the summer of 1975, another spionid larva was found, it is believed to be <u>Prionospio</u> sp. (<u>P. malmgreni</u>), it had black eyes rather than red, but there is some dispute amongst specialists as to the validity of this species. The larvae were of an advanced stage, with two pairs of black eyes, rounded prostomium and palps of medium length. The parapodia were biramous with the posterior neuropodia having hooded hooks and capillaries, all the rest had only capillaries, the notopodia also had capillaries. There were both dorsal and ventral cirri and six pairs of branchiae.

Another spionid that was often found in the spring 1975 plankton tows, was never positively identified but it is believed to be Spio sp.. It was 16-setigerous segments long with one pair of eye spots, a pair of grooved, ciliated anterior palps, dorsal cirri and branchiae anteriorly as well as simple notosetae and compound neurosetae (fig.s 20-22). The larvae appeared to feed on debris in the culture dish and when irritated they would curl up in a ball and extend their cirri and setae for protection (fig. 22). Figure 21 is a cross section through the larva showing the characteristic parapodial features.

A spionid that was found only once in a plankton tow came from the Ala Wai canal in July. It was unusual because the frontal horns protruded from the proboscis (fig. 23). It had a pair of long, grooved, ciliated palps and two pairs of black eyes. It did not live long enough to permit a positive identification.

The spionids are the most common polychaete larval type found in the plankton and more work is needed on the identification of local species.

Figure 9 a,b,c. 10-setiger Polydora antennata:SPIONIDAE; 100x.

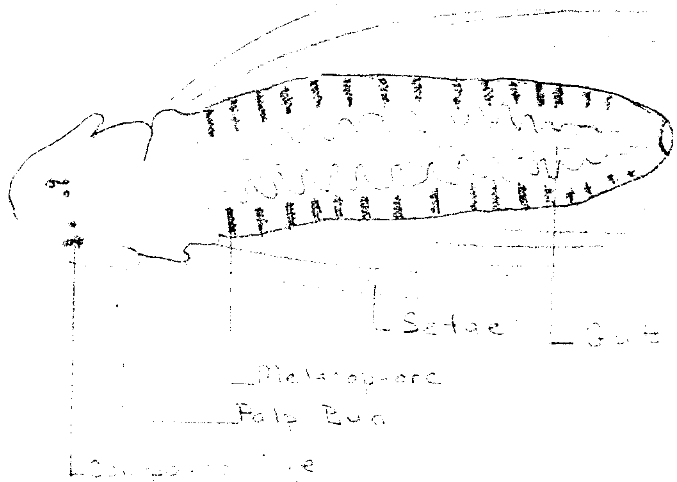
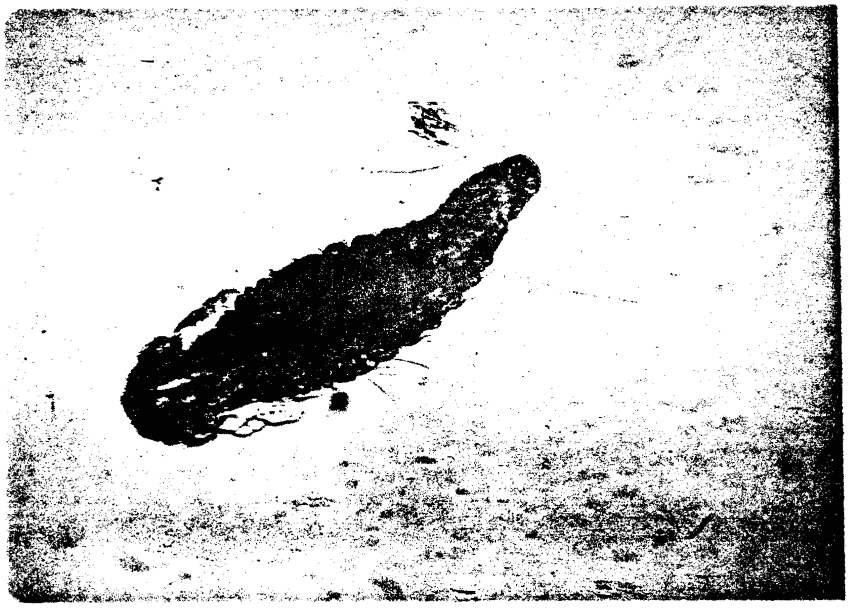


Figure 10. 17-setiger Polydora antennata:SPIONIDAE; 100x.



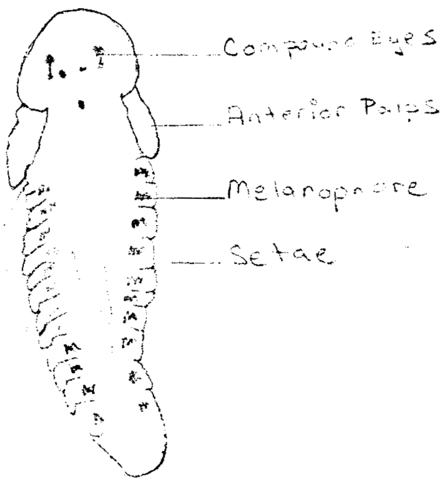


Figure 11. 13-setiger Polydora antennata:SPIONII

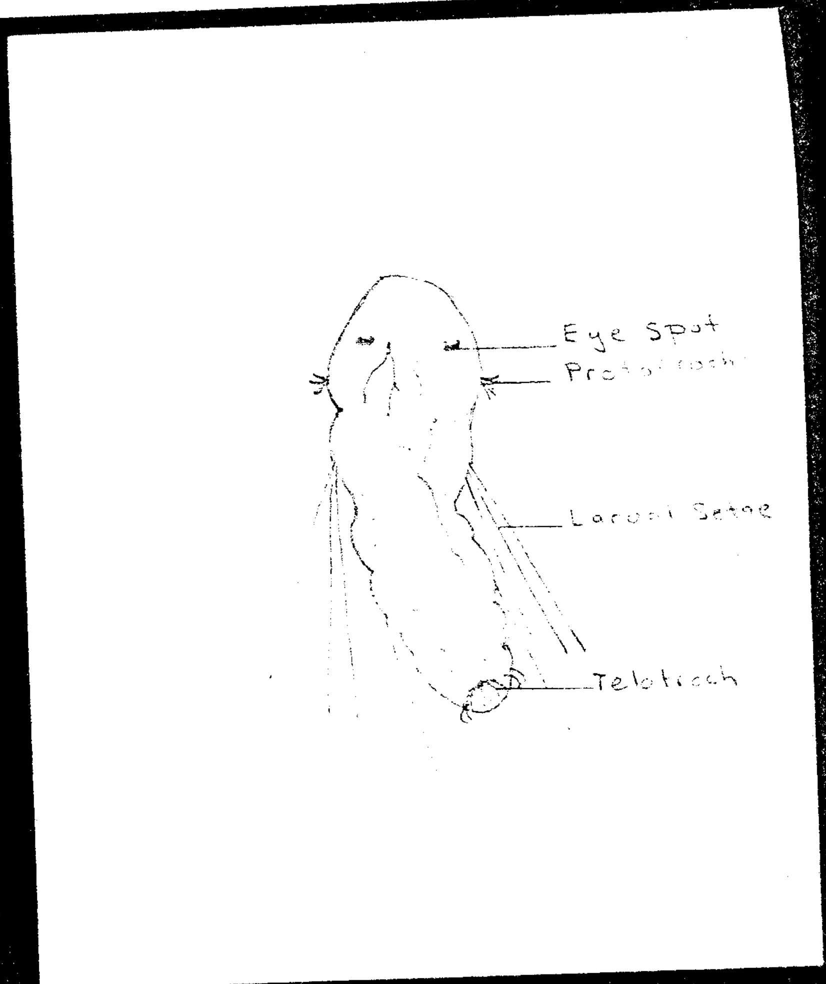


Figure 12. 3-setiger Polydora websteri:SPIONIDAE; 100x.

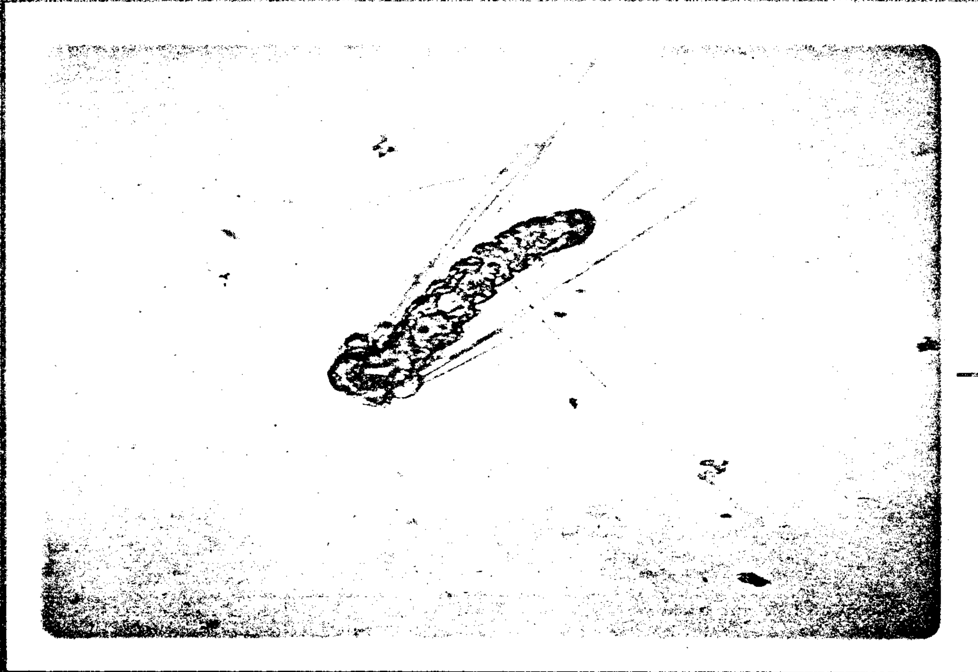
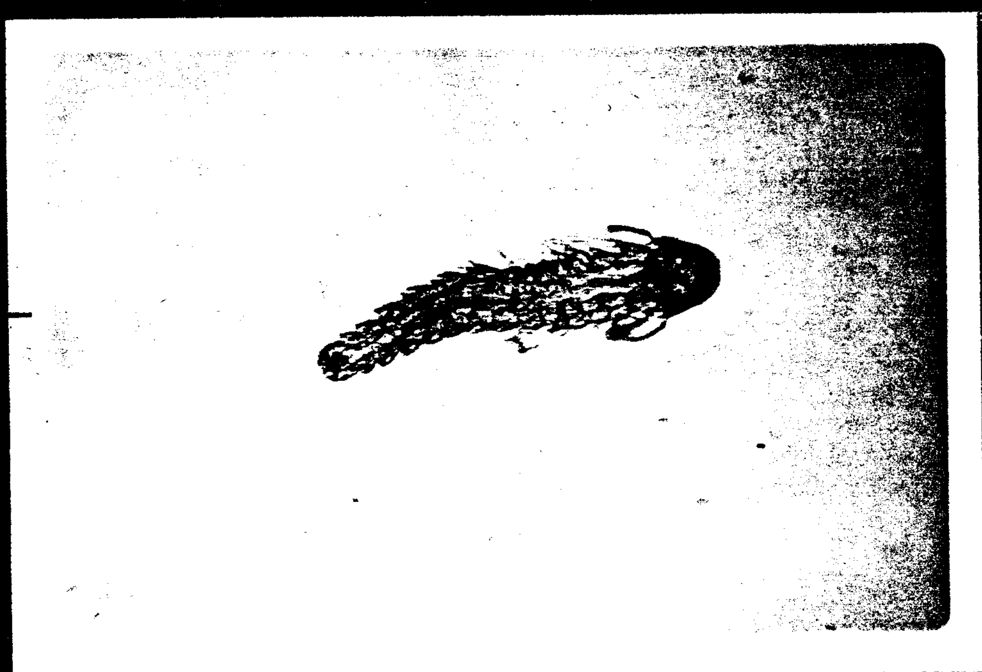


Figure 13. 8-setiger Polydora websteri:SPIONIDAE ; 100x.

Figure 14. 11-setiger Polydora websteri:SPIONIDAE; 100x.



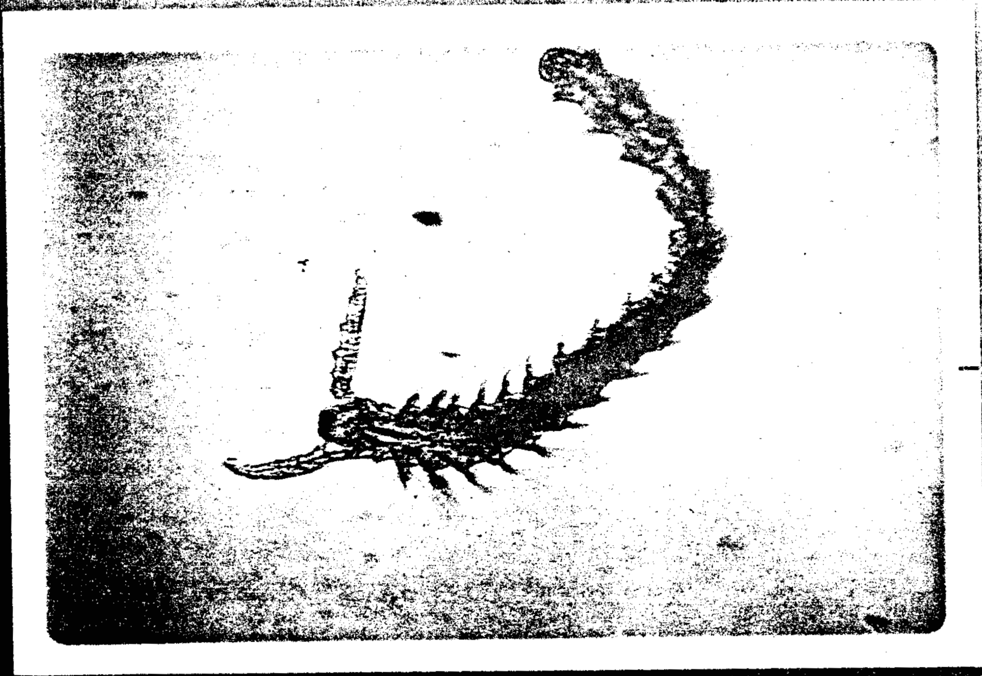
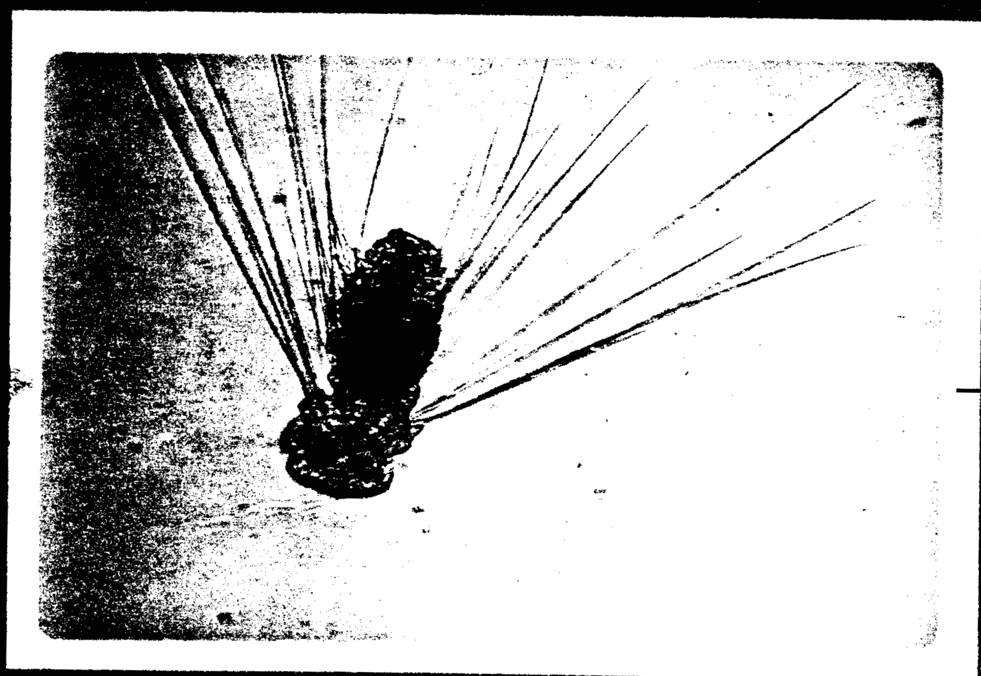
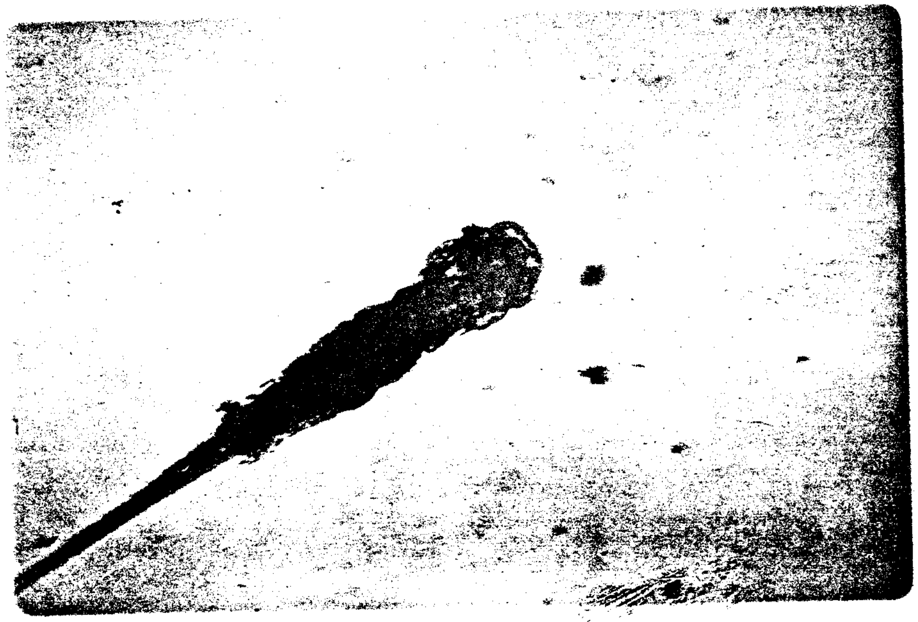


Figure 15. 17-setiger Polydora websteri:SPIONIDAE; 100x.

Figure 16. 8-setiger Polydora websteri:SPIONIDAE; 100x.





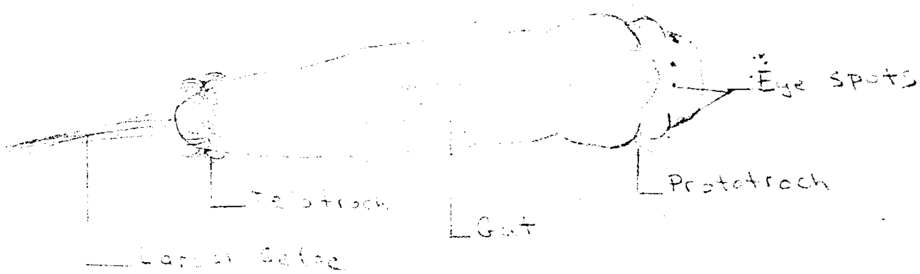
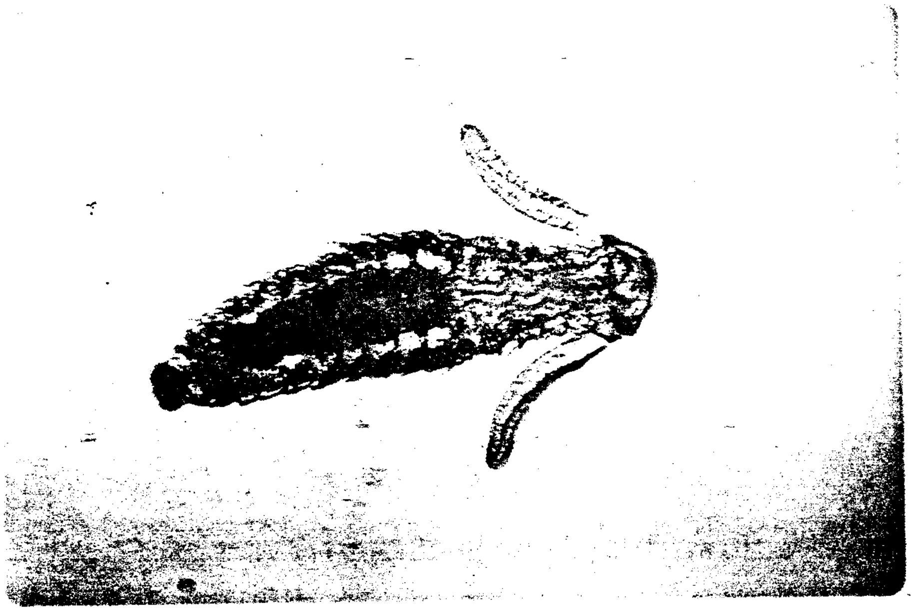


Figure 17. 8-setiger Polydora websteri:SPIONIDAE; 100x.



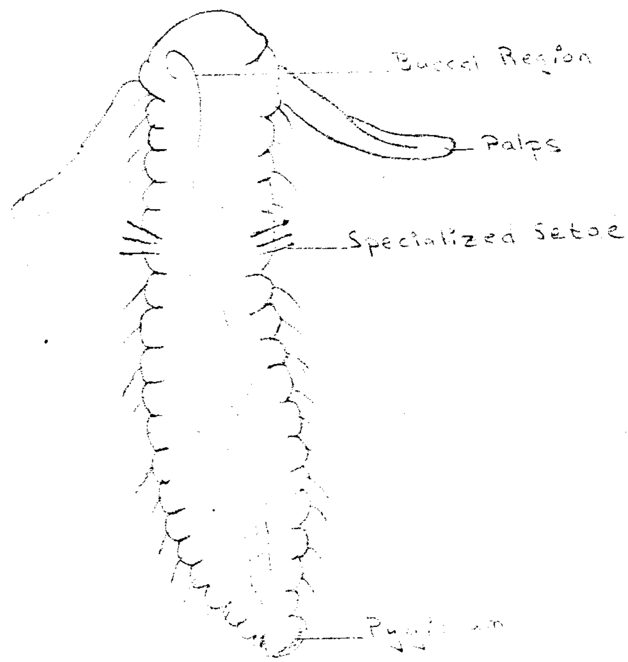


Figure 18. 18-setiger Polydora websteri: SPIONIDAE; 100x.

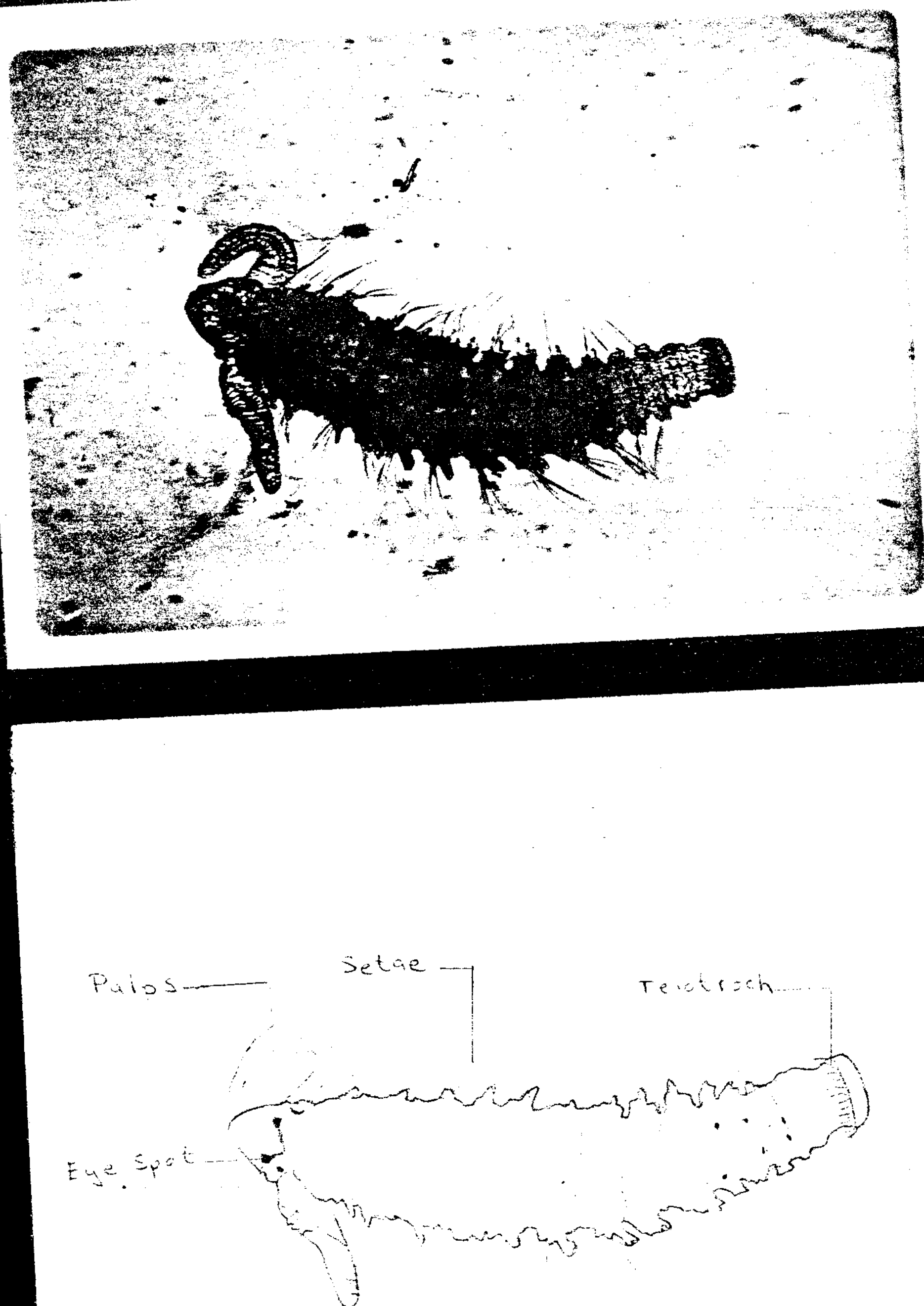
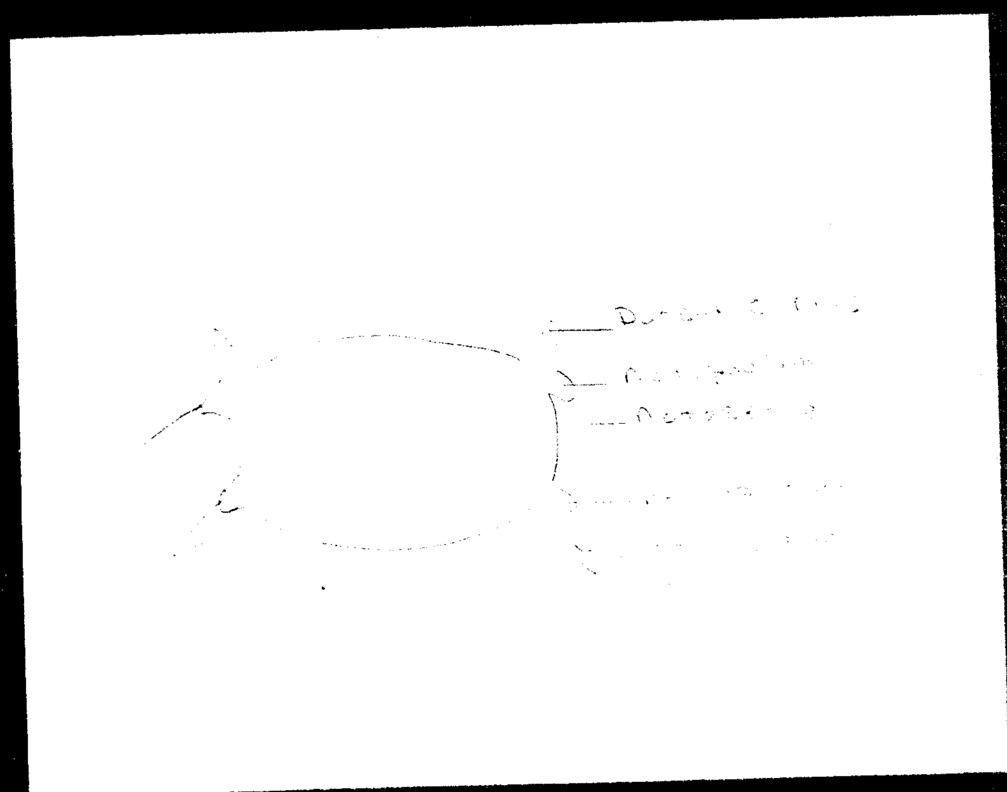
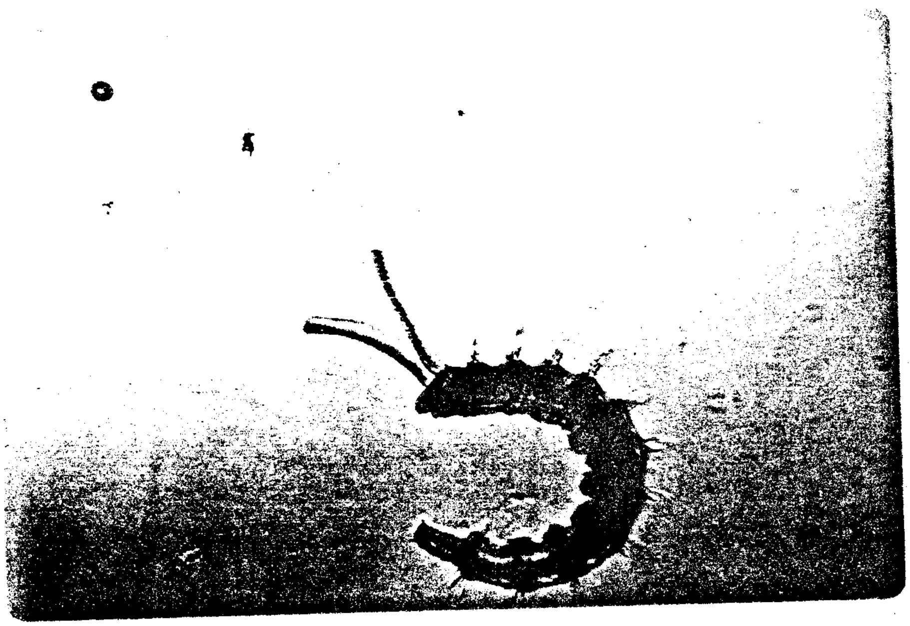


Figure 19. 14-setiger <u>Polydora</u> <u>websteri</u>: SPIONIDAE; 100x.

Figure 20. 18-setiger Spio sp.:SPIONIDAE; 100x.

Figure 21. 11-setiger Spio sp.:SPIONIDAE, cross sect





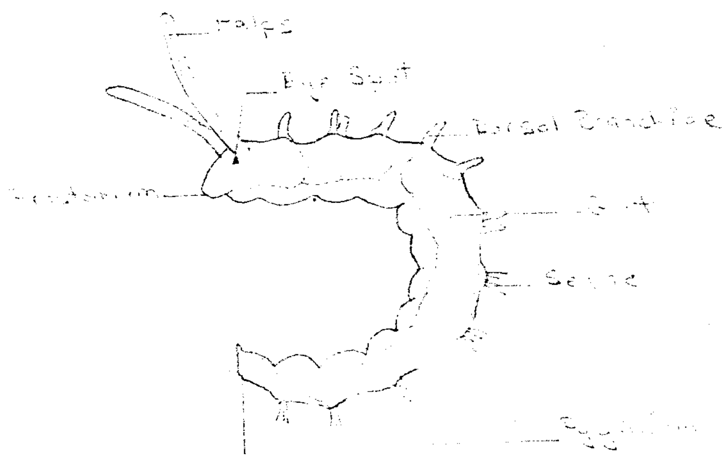


Figure 22. 11-setiger *Spio* sp.:SPIONIDAE ; 1

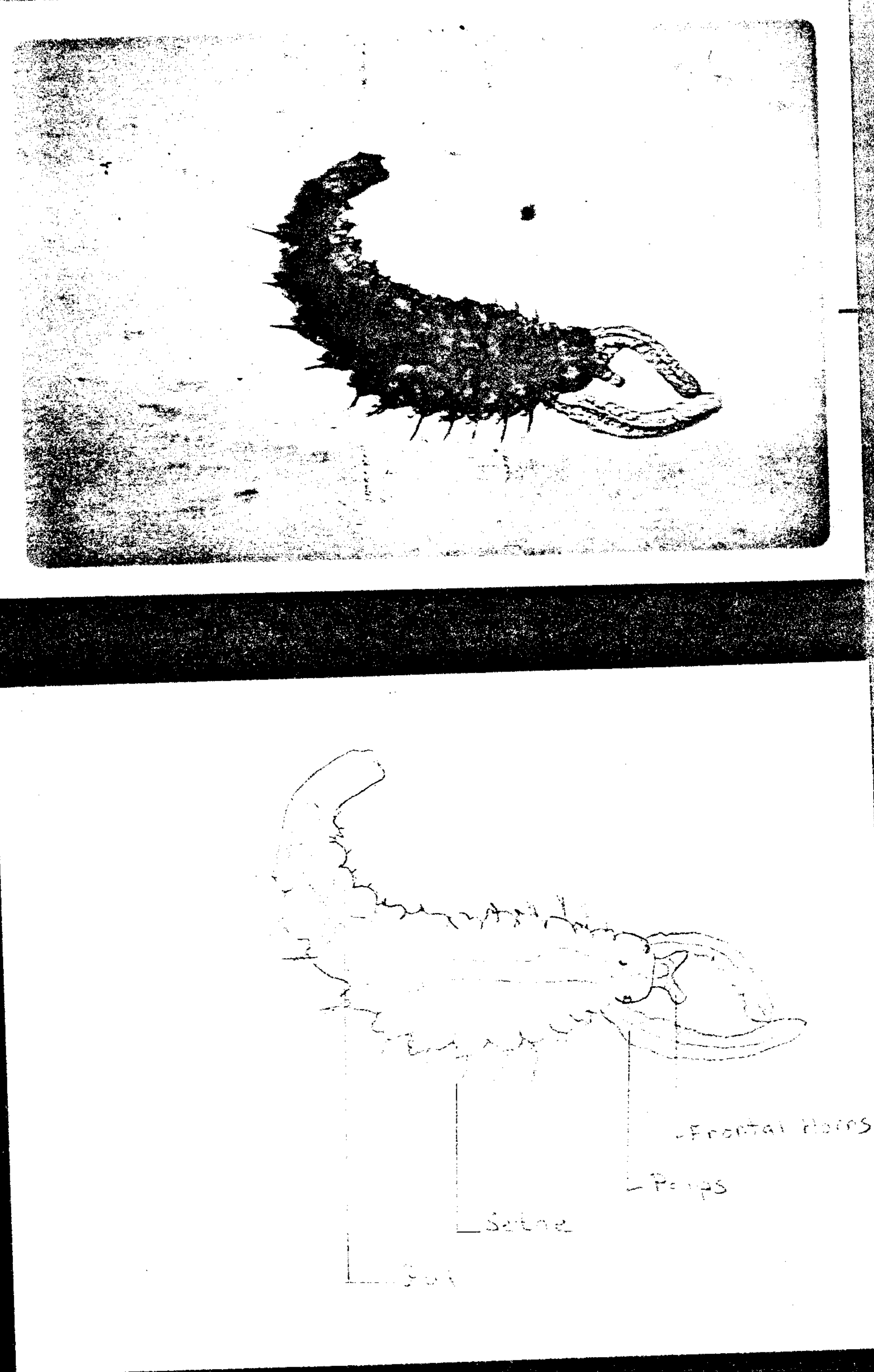


Figure 23. 13-setiger SPIONIDAE; 100x